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CLIMATIC PROVINCES OF THE RUSSIAN FAR EAST IN RELATION TO HUMAN ACTIVITIES

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In the extreme northeast of Siberia fish takes the place of bread. A fish famine brings the same dire results there as a bread famine in Europe. A large proportion of the population is engaged in fishing. In the success or failure of the industry climatic conditions play a considerable part. A fog in London may deprive many people of pleasure and may have some slight effect on retail trade and the stock exchange, but in far northeastern Siberia fogs may spell disaster to many hundreds of people. In this area the greater part of the summer is characterized by cloudy or foggy days which not only reduce the catch but are unfavorable to its preservation. The lack of salt and the primitive methods of salting compel the fishers to resort to sun-drying. But drying of the fish must take place in the second half of July and in August when clear days are few and far between. Fortunately, however, as if in compensation for this niggardliness Nature sends cold weather early, thus providing an alternative method of preservation—by freezing.

Besides cloudiness there are other climatic factors which militate against the fishing industry—the long winter, the freezing of the harbors and closure of navigation, the autumn cold spells, and the strong winds. The effect of such conditions might be indicated for other branches of industry. What they are and how they affect different parts of the great region known as the Russian Far East it is the purpose of this article to describe.

DOMINANT FACTORS IN THE CLIMATE OF THE RUSSIAN FAR EAST

The Russian Far East comprises the four administrative provinces of Amur, Primorskaya (Maritime Province), Sakhalin, and Kamchatka. The territory covers an area of approximately 937,000 square miles, three and a half times the size of Japan.

The territory forms a longitudinal strip extending from within the Arctic Circle to about the latitude of New York and lying between the greatest body of water in the world and the greatest land mass. It is dominated by winds of a monsoonal type. The easterly and southeasterly winds of summer bring the greater part of the rainfall, the westerly and northwesterly winds of winter bring dry cold. The pole of winter cold, in northeastern Yakutsk Province, is not far distant. On the other hand the region is clearly distinguished from the Siberian interior by modification of continentality, partly due to proximity to the sea, partly to the relief. In respect of the influence of

the sea, note should be made of the dominantly cold currents originating in the Sea of Okhotsk, in which floating ice is found the greater part of the year. The warm Kuro-siwo has very limited effect in the region.

As a whole the relief of the region is considerable. The Stanovoy and Khingan Ranges constitute a barrier against the cold winds of the Asiatic interior and limit the zone in which is felt the moderating influence of the sea. In detail the effect of the orography is seen in the pronounced local variations in climate. Some of the sheltered valleys are warm and, accumulating a deep snow cover in the winter, have a warm soil also. In others the phenomenon of temperature inversion is pronounced. A local influence is also exerted by the cover of *taiga*, the damp, tangled Siberian forest. The diurnal effect, higher night and lower day temperatures, is quite appreciable, and there is also a slight seasonal modification of temperature.

The several climatic regions into which the Russian Far East can be subdivided will now be described.

THE ANADYR-CHUKOTSK REGION

The Anadyr-Chukotsk region covers an area of 222,000 square miles and consists of three parts, the southern part or basin of the Anadyr, the northern, practically uninhabited and scarcely known save along the Arctic shore, and the eastern peninsula, Chukotsk (Chukchi). The relief of the Anadyr subregion is very diversified. A central depression is flanked on the west by a branch of the Stanovoy Range; on the east appear the harsh crest lines of the range extending north from Kamchatka. In the northern and eastern regions are long ranges, disorganized groups of mountains, plateaus, and hilly lowlands. The ranges, however, do not attain any great elevation, and relief here lacks the significance that attaches to it elsewhere in the Russian Far East.

Data on climate are scant. We have records from the stations of Markovo, 200 miles up the Anadyr, and Novo-Mariinsk at the river mouth, and the coastal strip is known to some extent from the observations of travelers and navigators, Nordenskiöld and Bogdanovich in particular. The general opinion of travelers is expressed in the words of Captain Billings¹ who explored the Chukotsk peninsula from Bering Strait to Nijnekolymsk towards the end of the eighteenth century: "The land of Chukchi is nothing but a mass of naked stones; its climate is most unbearable, nothing like summer until the 20th of July, and about the 20th of August the approach of winter is noticeable." The climate of this northern extremity of Asia cannot, however, be dismissed in quite so summary a fashion; though it is true that it is distinguished by its severity and arctic character, as observations at the meteorological stations show.

The mean annual temperature of Novo-Mariinsk is -7.9°C . (17.8°F .); Markovo is more extreme and has a still lower average for the year, -9.1°C . (15.6°F .).

¹ G. Sarychev: Journey of Captain Billings through Chukchis Land, St. Petersburg, 1811.

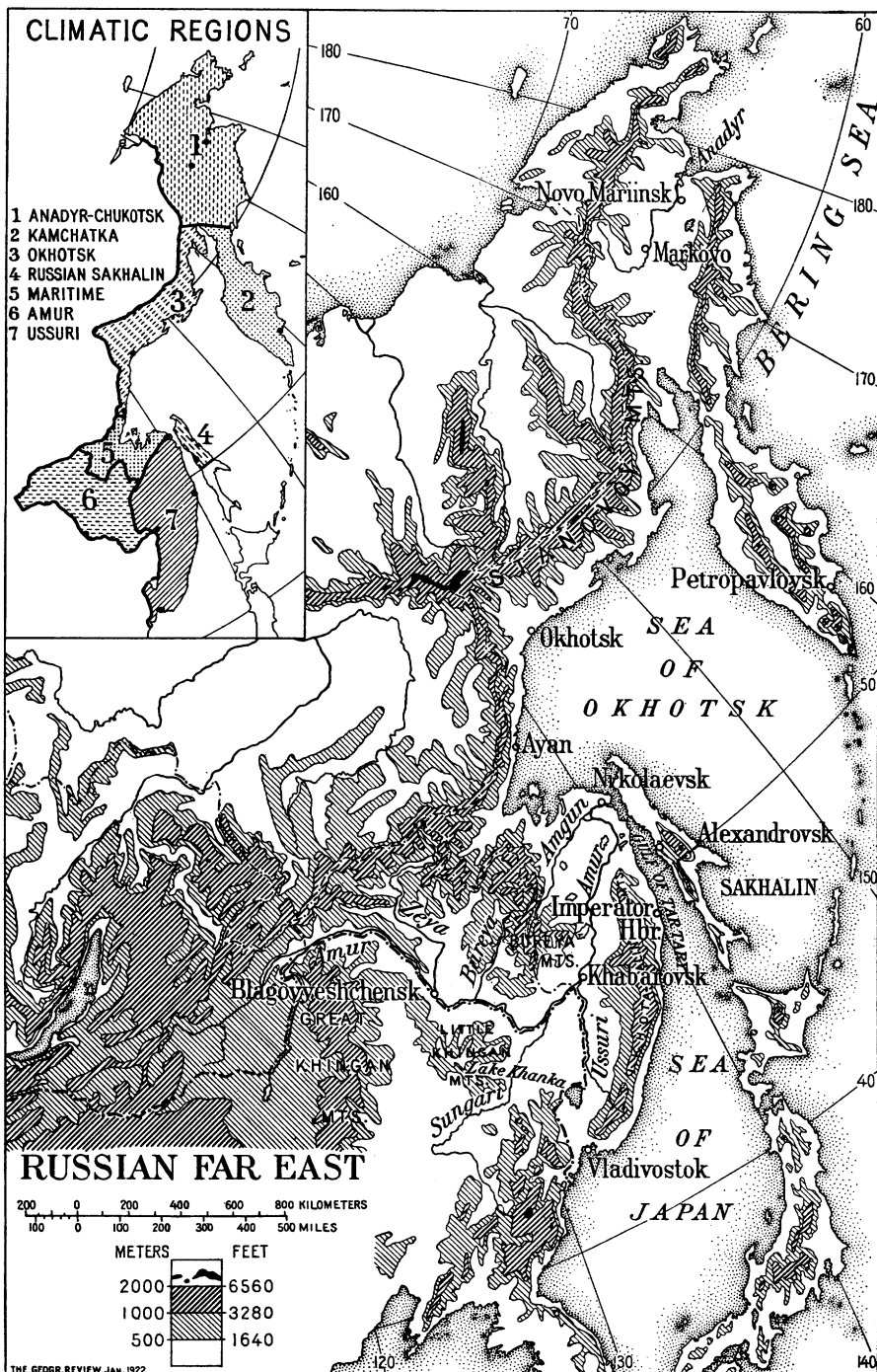


FIG. 1

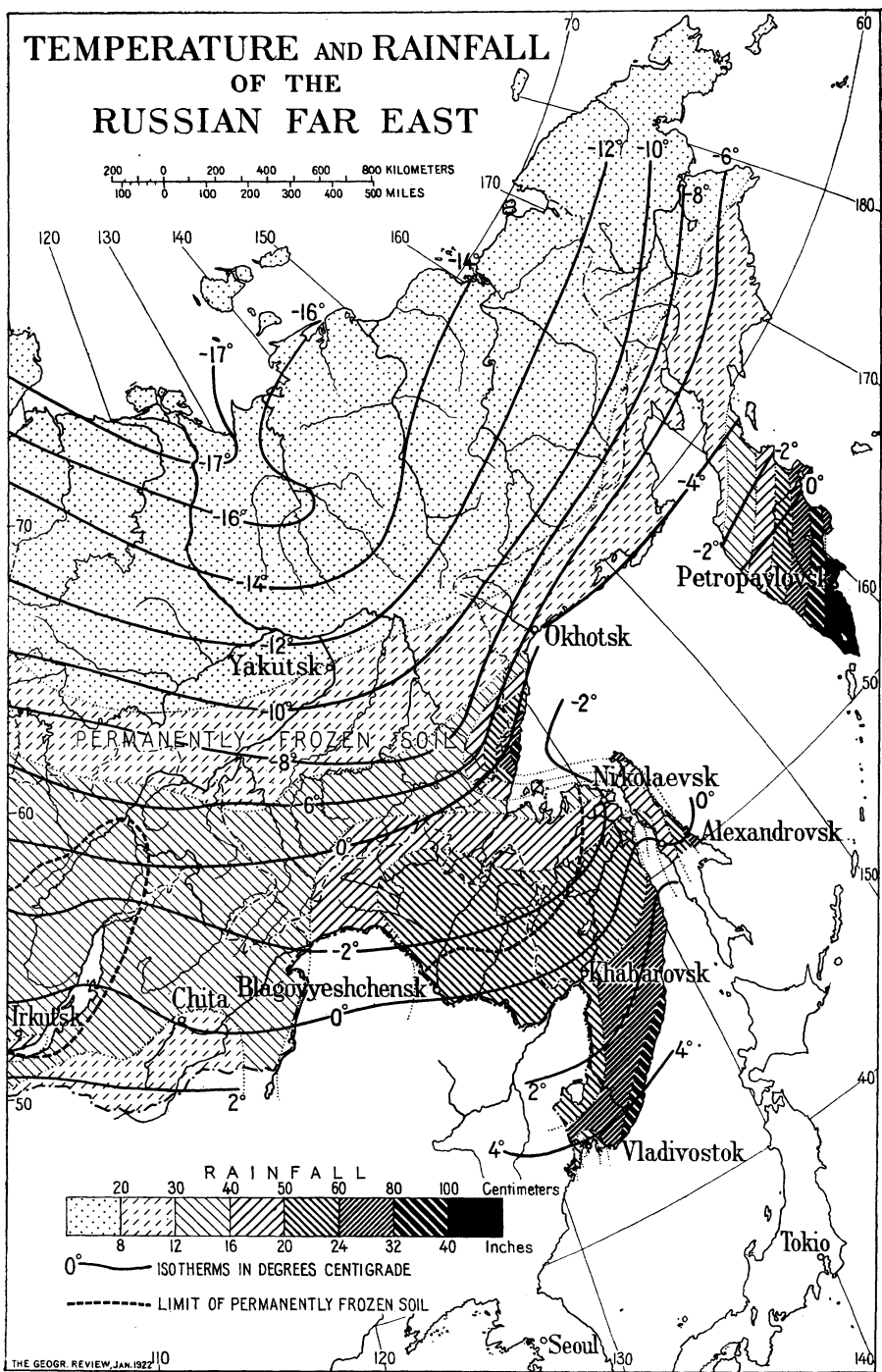


FIG. 2

TABLE I—MEAN MONTHLY AND ANNUAL TEMPERATURE IN THE RUSSIAN FAR EAST
(In degrees Centigrade)

STATIONS	LATI- TUDE	LONGI- TUDE	YEARS OF RECORD	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
ANADYR-CHUKOTSK REGION																
Novo-Marinsk	64° 45' N.	177° E.	6	-22.6	-24.9	-20.0	-13.4	-2.9	-4.9	11.2	9.3	3.7	-5.0	-14.8	-20.9	-7.9
Markovo	64° 45'	170° 50'	9	-30.1	-27.1	-21.2	-13.8	-2.3	10.3	14.2	10.5	3.2	-8.3	-19.6	-25.1	-9.1
KAMCHATKA REGION																
Petropavlovsk	52° 53'	158° 47'	8	-10.8	-11.3	-7.5	-1.6	2.8	7.4	11.5	12.3	9.6	4.0	-2.3	-5.8	0.7
OKHOTSK REGION																
Okhotsk	59° 21'	143° 17'	5	-23.1	-22.4	-15.0	-6.4	0.7	6.1	12.4	12.1	7.8	-2.7	-14.5	-20.7	-5.5
SAKHALIN REGION																
Alexandrovsk	50° 54'	142° 10'	20	-19.5	-15.7	-9.7	-0.4	5.1	10.7	15.9	16.2	12.0	3.9	-5.4	-13.1	0.0
NIKOLAEVSK REGION																
Nikolaevsk	53° 8'	140° 43'	19	-24.5	-20.5	-12.0	-1.8	4.0	11.4	17.1	16.1	11.7	2.2	-9.0	-19.1	-2.0
AMUR REGION																
Blagovyeschensk . . .	50° 16'	127° 0'	10	-24.0	-18.7	-9.0	2.5	10.5	17.6	21.3	18.9	12.6	1.2	-9.8	-20.6	0.3
Cherniaev	52° 47'	126° 0'	5	-27.5	-21.5	-12.3	0.5	9.5	16.5	19.3	17.0	10.3	-2.4	-16.2	-24.3	2.6
USSURI REGION																
Khabarovsk	48° 28'	135° 7'	8	-23.4	-18.7	-9.2	3.0	11.0	17.4	21.2	20.0	13.2	4.0	-7.7	-18.5	1.0
Vladivostok	43° 7'	131° 55'	20	-13.8	-10.3	-2.7	4.9	10.0	13.9	18.6	21.0	16.8	8.8	-0.1	-9.3	4.9

TABLE II—MEAN MONTHLY PRECIPITATION IN THE RUSSIAN FAR EAST
(In millimeters)

STATIONS	YEARS OF RECORD	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
ANADYR-CHUKOTSK REGION														
Novo-Marinsk	7	9.6	4.9	6.3	9.0	9.0	29.4	43.7	53.6	41.5	34.1	19.9	13.2	272.9
Markovo	11	7.6	6.6	7.2	3.9	5.2	22.9	33.3	36.8	29.4	11.7	8.8	8.3	181.8
KAMCHATKA REGION														
Petropavlovsk	10	60.4	50.4	51.1	49.3	63.1	66.7	73.0	119.7	100.9	130.4	85.4	59.3	920.9
OKHOTSK REGION														
Okhotsk	4	1.7	1.1	4.0	16.6	19.5	52.5	50.9	25.5	36.3	24.0	2.8	4.9	236.8
SAKHALIN REGION														
Alexandrovsk	5	49.0	24.8	54.0	32.4	34.8	23.0	53.0	42.8	89.5	96.8	30.2	60.8	591.1
NIKOLAEVSK REGION														
Nikolaevsk	16	24.0	15.5	21.1	35.0	29.7	29.5	51.3	82.8	66.1	66.3	38.3	28.4	496.1
AMUR REGION														
Blagovyeschensk	5	3.9	0.3	1.8	16.4	52.5	67.9	135.2	122.2	98.5	29.8	5.6	1.8	535.9
Cherniaevsk	6	2.5	2.5	5.1	14.1	43.3	54.9	91.1	100.5	34.7	15.9	7.2	6.2	378.3
USSURI REGION														
Khabarovsk	4	4.1	7.2	10.2	23.0	61.4	100.5	107.1	113.9	54.5	36.3	14.8	11.5	544.6
Vladivostok	18	6.1	7.9	11.3	25.8	53.0	63.2	74.1	132.9	108.8	45.4	13.4	11.6	554.5

Spring and autumn are so short that only two seasons can be properly recognized, winter which lasts nine months and summer lasting three months. This explains the fact that nearly all the soil of the region is permanently frozen, never thawing to a depth of more than 20 to 40 centimeters below the surface.

Though precipitation is small (10 inches in Novo-Mariinsk, 7 inches only in Markovo), humidity is high; and the percentage of cloudy and foggy days is very great. The average for many years gives Markovo only 63

clear days a year, Novo-Mariinsk, 69. In general only one month in Markovo (July) and two in Mariinsk (July and August) are free from snowfall; but the number of snowy days is not great—for the former station it averages 72, for the latter 71—nor is the fall heavy. The River Anadyr is ice-free for about four months, mid-June to mid-October.

The vegetation is naturally feeble and scant. In the more westerly part and the middle of the Anadyr basin there is a stunted forest growth, chiefly poplar, alder, and larch. A sizable broad-leaved forest is found on the mountain slopes upstream of the Anadyr and its tributaries. In general the boundary line of the forested area may be placed at 169° E. longitude. Eastward is tundra, frozen in winter, swampy in summer. Forest growth is in part restricted by the powerful

AVERAGE LENGTH OF SEASONS



FIG. 3—Average length of seasons in the Russian Far East.

destructive winds that carry masses of frozen snow mixed with sand and exercise a marked scouring effect on the rocks.

At Markovo the frost-free period ranges from 65 to 90 days, and the vegetative period is correspondingly short. The period of active growth is considered as that with the average daily temperature reaching 6° C. (43° F.) or more. At Markovo it extends from June 4 to September 10, and the total of heat units (total of average daily temperatures above freezing point) for this period is 1,204. Now 1,000 heat units are sufficient for agriculture in some circumstances, but here there are other unfavorable conditions—the high degree of humidity, and cloudiness, the number of rainy days in the summer season, the cold winds. Inhabitants of Markovo have attempted to grow vegetables, but the results were not worth the time and trouble that

had to be expended. The basis of life in this region depends upon the sea fisheries, hunting, and reindeer breeding.

THE KAMCHATKA REGION

The Kamchatka region includes the peninsula of that name and the adjacent islands. The northern part of the peninsula is plateau diversified by hills and open to the influence of the Bering and Okhotsk Seas. The rest of the region is characterized by two parallel ranges of volcanic mountains running its length and separated by the wide valley of the Kamchatka River.

The climate of Kamchatka is distinctly milder than that of the Anadyr-Chukotsk region. Winter lasts $6\frac{1}{2}$ months instead of 9, and there is a comparatively long spring. The mean annual temperature (for an eight-year period) of Petropavlovsk is 0.7°C . (33°F .).

Orography and the direction of the prevailing winds—westerly in winter and easterly in summer—clearly differentiate the eastern and western coasts. However, they may both be described as having a semi-oceanic climate, while the shut-in central section is semi-continental and the exposed north cold continental in character. The lowest mean monthly temperature of Petropavlovsk (February) is -11°C . (12.2°F .), and the minimum -20.4°C . (-4.7°F .); the highest monthly mean (August) is 11.7°C . (53°F .), and the maximum 26°C . (78.8°F .). Petropavlovsk is on the eastern shore, and its temperature appears to be influenced to some extent by a drift (Kamchatka Current) from the warm Kuro-siwo. Bolsheretsk on the western shore is colder, while Kluchevskoye in the interior is still more extreme. The lowest mean monthly temperature at the latter (January) is -18.2°C . (-0.7°F .), and the minimum (February) -36.3°C . (-33.3°F .); the highest monthly mean (July) is 12.1°C . (53.7°F .), the maximum (June) 24.9°C . (76.8°F .).

Precipitation in the Kamchatka region is comparatively heavy and is more equably distributed through the year than in any other region of the Far East. Fifty per cent of the fall is as snow. Indeed, the peninsula is renowned for its violent snowstorms. The huge snowdrifts do not melt until late in the year. The fishermen, who gather about the middle of May to resume fishing, often find their stations completely snowed under. A cold and snowy winter, however, is frequently followed by bright sunny days, especially in March which is the most convenient month for making trips over the country. The rather considerable heat of the sun alternating with the night cold helps to form a solid crust of ice on the surface of the snow, thus facilitating driving. "During this season," says Ditmar,² "all the localities of the peninsula seem to be drawn closer together, as the distance between them is more rapidly covered."

The Petropavlovsk section of Kamchatka is situated in the same latitude as Samara, the great wheat-growing region of the middle Volga, but experi-

²K. Ditmar: Kamchatka, St. Petersburg, 1901.

ments in cereal production in the former district have proved failures. While the grain reaches a formidable height, the ears form very late and are either caught unripened by the frosts or ripen in September to a poor yield. The total of heat units for the vegetative period, May to September, is 1,507 for Petropavlovsk and 1,651 for Kluchevskoye, but the destructive frosts of late spring and early fall, the clouded skies of summer, and the high humidity are deterrent.

On the basis of climate and topography the natural vegetation of the peninsula may be subdivided into coastal and inland types. In the former, shrubs and tundra predominate; in the latter, conifers. The meadows with their luxuriant grasses furnish good grazing for cattle.

THE OKHOTSK REGION

The Okhotsk region is a narrow strip along the northern and western shores of the Okhotsk Sea extending from the border of the Maritime Province to the northwestern corner of Kamchatka. It is cut off from the neighboring regions by the Aldan Mountains, the numerous branches of which give the coastal region a hilly character everywhere except in the north. The considerable relief in combination with the effect of the cold waters of the Okhotsk Sea make the climate abnormally cold and damp for its geographical position. The mean annual temperature of Okhotsk (town) is -5.5°C . (22°F). The presence of masses of floating ice along the shores lowers the temperature of spring and summer. The former season is much shorter here than in Kamchatka, shorter even than in the Anadyr-Chukotsk region. Associated with the coldness of the sea waters is the prevalence of foggy and cloudy days. Thus in 1915 the town of Okhotsk had only two clear days in June, none in July, seven in August.

The winter is very cold, fairly snowy and stormy, and at times subject to spells of extreme cold. Autumn also is short and cold. Very low minima are observed even in October; for example in 1915 the October minimum for Okhotsk was -21.3°C .

Although the number of heat units received during the vegetative period, June to September, is not inconsiderable—1,057 for Okhotsk—the same unfavorable factors, principally lack of direct sunshine, operate as in the Kamchatka and Anadyr-Chukotsk regions and preclude all possibility of agriculture beyond the raising of certain vegetables.

The humidity of the climate, to which the slow thawing of the snow on the mountains and the *taiga*-covered slopes appear to contribute, is especially unfavorable. Heavy dews are experienced in the late summer and early autumn. The effect of the unusually high degree of moisture in the air has been described by Dr. Slunin:³ "On the steep banks eroded by the river in its course there hung on every leaflet and stalk, as well as on the roots of shrubs and plants, beads of silvery dew refracting the rays of the morning

³ N. Slunin: Okhotsk District and Kamchatka, St. Petersburg, 1900.

sun in the colors of the rainbow. Large glittering drops fell from every peat mound. The whole tundra, as they say, was weeping. As you glide down a river in a canoe, you meet with the like enchanted scenery for miles and miles and day after day. We were sometimes driven desperate by the unbearable moisture of the air."

The open exposed plain of the extreme north of the region is tundra; the remainder of the country is largely covered with *taiga* in which the trees, especially near the coast, are deciduous for the most part—birch, poplar, and alder. The influence of the wind on forest growth is most pronounced. In sheltered valleys tall fine trees are found; in exposed places they are stunted and twisted to an extraordinary degree.

The general poverty and monotony of the region is such that one cannot but admire the inventiveness of the native in his utilization of the natural resources. From a nettle the Koryak and Kamchadale manufacture a kind of hemp; from the sea grass, one of the most luxuriant features of the flora, they braid bags and mats; a species of alder gives material for the dyeing and tanning of reindeer hide.

THE SAKHALIN REGION

The island of Sakhalin stretches as a long narrow band along the eastern shore of the Maritime Province, being separated from it by the northern part of the Japan Sea. The northern part of the island, that belonging to Russia, has an area of about 15,000 square miles. The island is traversed by a series of meridional mountain ranges. The first of these ranges stretches from the northern tip of the island to latitude $51^{\circ} 21'$, from which point southward the inner part of the island is lowland, the basin of the Tymy River, the largest river of Russian Sakhalin. Flanking the central lowland are western and eastern coastal ranges. Nowhere is the elevation great. Even the highest peaks of the Eastern Coastal Range do not rise over 3,000 feet.

The climate of Sakhalin, generally speaking, is cold and humid, especially on the coasts. Alexandrovsk on the west coast has a mean annual temperature of 0° C. This coast, facing the Straits of Tartary, is somewhat milder than that of the east, facing the Sea of Okhotsk, and appears to show the influence of a branch of the Kuro-siwo diverted thither from the stream passing through La Pérouse Strait.

The average annual precipitation in Sakhalin is about 600 millimeters (24 inches) and, like that of Kamchatka, is well distributed through the year though still heavier in the summer and autumn. The summer rains are noted for their intensity. Snow falls eight months of the year, from October to May.

Heat units during the vegetative period at Alexandrovsk, April 27–October 2, amount to 1,934; but the same objectionable factors are present as in the Okhotsk region. In particular mention should be made of the salt

sea fogs of the coastal regions. The sheltered valley of the Tymy is, however, more favorably circumstanced.

The considerable variation of climate throughout the length of Russian Sakhalin, 900 miles, is well reflected in the vegetation. Tundra occurs in the north; but nine-tenths of the island is wooded, and the southern portion has a rich variety of species, northern and southern forms mingling. In the latitude of Alexandrovsk the Kurilian bamboo is found. The vegetation appears to be richer for the most part on the mountain slopes facing the Straits of Tartary, much poorer on the slopes exposed to the Okhotsk Sea. Emphasis must be laid on the effect of local conditions. The estuary of Poronay (in Japanese territory), lying in an exposed situation, has a typically arctic flora; while in the extreme north are sheltered spots where tundra is replaced by trees.

THE NIKOLAEVSK REGION

The Nikolaevsk, or Udsck, region is coincident with the administrative subdivision of Uda, the main portion of which in 1914 was separated from the Maritime Province and temporarily placed under the local Sakhalin government. A large part of the region, particularly north and west of the Amgun, is practically unknown country. The area of the region is about 38,000 square miles, and it is very scantily populated. In 1909 there were only 13,749 souls of whom 12,700 lived in the city of Nikolaevsk. The relief is generally mountainous, though there are several extensive depressions. A continuation of the Little Khingan of northern Manchuria traverses the southern part of the region as the Bureya range and reaches altitudes of 3,000 to 5,000 feet above sea level. In the north are ramifications of the Stanovoy Range. The most important lowland is that of the Lower Amur which in its central part attains a width of 100 miles.

The climate of the best known part of the region is subject to influences similar to those obtaining in the Okhotsk region. The winter is severe and lasts almost half the year. Spring and summer are late and short especially near the coast, washed as it is by ice-laden currents. Thanks to the presence of the sea, however, the autumn is warmer along the shore and may be considered the best season of the year.

There is considerable local variation in temperature. Layers of cold air tend to accumulate in the depressions and flow along the river courses. For this reason the Amur valley stays very cold. During January the average temperature of Nikolaevsk drops to -24.5°C. , while Ayan, situated farther north, has a temperature 6° higher. The length of the winter, with closing of the Lower Amur to navigation from the end of October until the middle of May, has been deterrent to the growth of Nikolaevsk; while its rival Vladivostok, climatically better favored, has succeeded. Of course other circumstances have also hampered development of the port—the bar at the mouth of the Amur, the lack of railroads and general backwardness of the hinterland, and military contingency. The mean monthly temperature is the same for the two stations, -2°C. (28°F.).

The rainfall is typically distributed. Thus in 1914 the total precipitation for Nikolaevsk during the six cold months was 88 millimeters (3.5 inches), for the six warm months 231 millimeters (9 inches). Other stations in the region show a more marked seasonal difference. Thus for Mariinsk, up the Amur, the seasonal distribution was 64 millimeters (2.5 inches) and 441 millimeters (17 inches) respectively. Unlike the case in the Okhotsk region fogs are of infrequent occurrence here.

The comparatively high temperatures of summer and autumn suggest possibilities of agriculture. At Nikolaevsk the total of heat units for the period of active growth is 1,752; the figure is higher for southern parts of the interior. The inhabitants of Novo-Sergievskoye, a village a few miles from Nikolaevsk supply themselves entirely with grain and sow fall rye and barley. Within a radius of some 100 miles from Nikolaevsk almost all kinds of grain ripen—rye, oats, and wheat; and 150 miles north of Khabarovsk even watermelons ripen well. Thanks to the industry of its Korean gardeners the city is supplied with home-grown vegetables in excess of its needs, and in recent years the surplus has been shipped south to Khabarovsk and Blagovyeshchensk.

THE AMUR REGION

The Amur Province occupies an area of some 155,000 square miles. Across the northern part stretch the Stanovoy Mountains. The range, which here has a latitudinal direction, constitutes the boundary between the Yakutsk and Amur Provinces. The average height of the summits approximates 3,500 feet, individual peaks reaching 7,000 feet. From Manchuria the Great Khingan Mountains enter the southwestern corner of the region, forming the boundary between this province and that of Transbaikal. In the eastern part the Buryea Mountains continue the Little Khingan. Several minor ranges diversify the topography. One feature that claims special note is the Zeya-Buryea lowland covering an area of 65,800 square miles along the Amur and the lower courses of its tributaries from the Zeya eastward to the Buryea ranges. It is sometimes known as the Upper Amur prairie, is fairly well populated, and offers good prospects for agriculture.

The climate of the province is markedly continental, average and absolute ranges being great. In Blagovyeshchensk the absolute range for 1914 was 64.6°, i.e. from -34.9°C. (-30.8°F.) in January to 29.7°C. (85.5°F.) in August. It is still greater in other sections in the northwest: Dambuki registers -53°C. (-63.5°F.) in January, 30.8°C. (87.4°F.) in July. Though there are local differences, over the broad area of the province considered as a whole there is a noteworthy uniformity, and the climatic type is distinctive. Thus for a number of widely dispersed stations the extreme difference in length of winter is only 19 days, ranging from 205 to 186 days. Everywhere winter cold is intense and uniformly maintained without sharp fluctuations and accompanying thaws. Thickness of ice on the Amur reaches from three to eight feet in January.

The distribution of snow is very irregular; but in general the fall is light—only four per cent of the precipitation—and the snow is fine and powdery and easily blown away. In some parts of the country sleds are not used, whereas over most of Siberia they afford the chief means of winter transportation. Lacking a snow cover the rivers freeze to the bottom, the earth cracks in big fissures, and winter crops perish. In places the soil freezes to depths of seven or eight feet and thaws slowly so that spring sowing is delayed. It is not surprising that permanently frozen soil is encountered in many parts of Amur Province, whereas in Sakhalin the phenomenon is unknown. The problem of permanently frozen soil is a complex one. According to the authority Professor Yachevsky it involves not only low air temperatures and deficient snow cover but geological and hydrographical conditions as well. With the coming of warm days the whole character of the weather changes sharply. Though the winds still come prevailingly from the west, they are less regular; the number of cloudy days increases as does precipitation; sometimes there are fogs. In contrast with the uniformity of winter is the inconstancy of spring. The most unfavorable phenomenon is the late frosts. Near Blagovyeshchensk they continue to mid-May, and longer farther north.

The distribution of rainfall is typical. It is greater in the east than in the west, but everywhere Amur Province shares with the monsoonal lands of eastern Asia the preponderance of summer rain. At Blagovyeshchensk 85 per cent falls in summer and autumn.

On the question of the suitability of the climate for agriculture there are differences of opinion. The short autumn and long winter with low temperatures and freezing of the soil preclude fall sowing in most of the area. On the other hand, the summer averages about three months. At Blagovyeshchensk the total of heat units is 2,380. On the other hand summer rains hinder the ripening of grain; the heavy falls of rain do not readily drain off, and plants tend to rot. The barriers to agricultural development do not appear to be insurmountable, however. Much could be done by improvement of methods of cultivation and the selection of suitable seed. It may be noted that the practice of burning the forests helps to create a "dry fog," a phenomenon of common occurrence from May to August.

The table on the next page shows the yield in 1911 of certain crops in Amur Province compared with yield in interior eastern Siberia and European Russia in the same latitude.

The natural vegetation of the Amur Province is rich and diversified. Though the climate is markedly uniform, subregions may be recognized based on the vegetation:

1. Southwestern section characterized by the eastern larch (*Larix daurica*) and with steppelike meadows on the drier mountain slopes.
2. Northwestern section with the eastern larch and the white birch and occasionally pine and more rarely fir.
3. Southeastern section with Manchurian flora predominating, and

including the Manchurian cedar, oak, several species of maple, elm, and walnut. Many species are not found or are rare west of the Amur basin.

4. Northeastern section with Okhotsk type of flora, Ayan fir spruce, and moss swamps.

5. Northern section of poor vegetation.

TABLE III—CROPS IN POUNDS FROM 2.69 ACRES (1911)

PROVINCES	SUMMER WHEAT	SUMMER RYE	BARLEY	OATS	BUCKWHEAT	PEAS	POTATOES
Kiev	1,376	1,312	2,432	2,944	1,984	2,880	17,920
Transbaikal .	992	1,248	1,024	1,120	480	800	13,920
Amur	2,048	1,696	1,952	2,240	1,280	1,920	16,672

In general there is much swampy soil. Grasses flourish in great variety but are not of great value for cattle.

Analogous to the diversity of plants is the diversity of the animal life. There is a mingling of forms; such northern species as the reindeer with such southern species as the tiger, western species as the hedgehog with eastern species as the raccoon.

THE USSURI REGION

The Ussuri region constitutes the southern part of the Maritime Province, and its area is estimated at about 200,000 square miles. It is named from the River Ussuri, the course of which for the last 300 miles forms the boundary between the region and Manchuria. The only important depression is around Lake Khanka. The Sikhota-Alin range enters from the south running south-southwest to north-northeast along the coast of the Japan Sea and filling the entire region with its ramifications. It is not a single massive range as appears on most maps but a series of parallel chains. The general summit level is 2,000 to 3,000 feet; the greatest heights, with individual peaks attaining over 5,000 feet, are found in the south and center; approaching the Amur the mountains become lower and more rounded. The southern shore cuts across the grain of the country and is rich in inlets. North of St. Olga Bay the trend of the coast parallels the mountains and is broken only by Imperator Harbor.

The climate is cold for the latitude. The mean annual temperature is some 10° C. lower than for corresponding latitudes in western Europe, yet climatically the region is the best favored of the Russian Far East. The winter at Vladivostok lasts not more than five months. The Sikhota-Alin range is an important climatic divide, particularly in the south where the cloudy, foggy coast lands are sharply differentiated from the sunny interior. In 1914, from April to August, there were 48 foggy days at Vladivostok, and at some stations on the south coast this figure was doubled. Altogether four

climatic subregions can be recognized: (1) Southern Coastal region, (2) Southern Interior, (3) Central, (4) Northern. As illustrative of the difference between them we may note the mean annual temperature for 1914. For Vladivostok on the southern coast it was 5.5°C . (42°F .); for Chernigovka in the southern interior, 3.9°C . (39°F .); for Khabarovsk in the central district, 1.5°C . (34.7°F .); for Emperor Harbor in the north, -0.8°C . (30.5°F .). This range is largely due to differences in winter temperature. However, Emperor Harbor, washed by the cold waters of the Gulf of Tartary, has an abnormally low summer temperature.

Precipitation comes chiefly in the form of heavy summer showers not infrequently causing disastrous floods. There is, however, a rather critical variation in rainfall. Thus during the period 1899-1907 the range at Vladivostok was 257 millimeters (10 inches) to 853 millimeters (33.5 inches). In 1914, 904 millimeters (35.5 inches) was recorded. The amount of snowfall is likewise irregular in amount and distribution.

Assuredly there is a great economic future for Ussuri. It is well favored in respect of its coastal location and good harbors and interior waterways, in the presence of coal, iron, and zinc ores and building materials, and the proximity of important markets. In relation to the development of such resources the question of agriculture is of prime importance. What are the possibilities as regards climate? In the southern parts of the region the vegetative period approaches 200 days in length and even in the extreme north surpasses 100 days. The total of heat units (1915) at Vladivostok is 2,393; at Khabarovsk 2,554; at Emperor Harbor 1,612.

The greatest obstacles to agriculture are, in the north, the coldness of the coast in spring; in the south, the slow heating of the soil insufficiently protected with snow in winter and the fogs.

The agricultural products of the Ussuri region are characteristically varied. Fall and spring wheat, rye, oats, barley, buckwheat, and hemp are grown; also watermelons, melons, cucumbers, and all root crops. The numerous Chinese and Korean immigrants raise millet, beans, and corn, all of which do well; and in the last few years rice cultivation has been attempted and, contrary to all expectations, has succeeded. In regions where rice is grown in Europe, America, and most other parts of Asia the summer has not less than three months with a temperature above 22°C . (72°F .). We may, however, note the development of rice cultivation in Hokkaido where temperatures also are comparatively low. The warmest sections of Ussuri do not always have even one month with a temperature above 20°C . Rice was first planted in 1918, and two years later 6,725 acres were devoted to the crop. According to the estimates of A. D. Woeikof this acreage should be increased tenfold in 1921. Table IV gives some idea of the agricultural development of the region.

An index to the possibilities of agriculture is seen in the rich variety of the natural vegetation. Ussuri shares with the Amur region its character as a meeting place of northern and southern forms. The vegetation furthermore

TABLE IV—CROPS IN THE USSURI REGION (1911)

CROP	AREA IN ACRES	CROPS IN ENGLISH POUNDS	NUMBER OF POUNDS PER 2.69 ACRES
Winter wheat . . .	228,800	120,528,000	1,344
Winter rye	4,420	3,065,600	1,760
Summer rye . . .	23,140	10,582,400	1,184
Barley	15,080	10,096,000	1,728
Oats	208,520	138,432,000	1,728
Buckwheat	82,560	33,536,000	1,088
Millet	17,420	20,505,600	3,072
Peas	1,580	935,600	1,632
Potatoes	27,520	138,304,000	14,144

attains great luxuriance. The forests are impenetrable with twining plants and vines; the grasses grow to great heights. Exposure and relation to the sea play an important part. Whereas northward-facing slopes are forested, southern slopes are apt to be forestless, for the alternation of warm days and freezing nights of February ruptures the plant tissues. The *taiga* on the southeastern slopes of the Sikhota-Alin presents an imposing appearance; but the summer dampness rots the heart of the timber, and it is useless for any purpose except fuel.